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ABSTRACT

This paper presents the results of a study to determine the relationships between educational innovation and certain school factors -- quality ranking, mean age of principals, length of superintendent tenure, amount of local revenue devoted to education, and district enrichment expenditure. Regression equations and explanations of report study findings were utilized in arriving at the conclusion that the best predictor of innovation -- among the variables tested in the study -- is the amount of local revenue the school district allocates to education. (Related documents are EA 002 282 and EA 002 246). (LLR)

OCCASIONAL PAPER NO. 3

RELATIONSHIPS

BETWEEN

INNOVATION AND SELECTED SCHOOL FACTORS

by

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INTRODUCTION

This is Occasional Paper No. 3. There are four others that have been completed:

No. 1 - Occasional Paper No. 1: "A System Analysis of Education in Kentucky Public Schools."

No. 2 - Occasional Paper No. 2: "School Reorganization and the Process of Educational Change."

No. 4 - Occasional Paper No. 4: "Education and Preparation for the 21st Century."

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RELATIONSHIPS BETWEEN INNOVATION AND SELECTED SCHOOL FACTORS[1/]

In recent years, many research projects have been directed at innovation in education. Much has been written about innovation, and the general public is becoming increasingly aware of changes in our public schools.

One of the difficulties frequently encountered in research involving educational innovation is that of determining whether or not a method or practice is a true innovation. If a program has been in existence for several years, it is not normally called an innovation. In addition, a practice which is considered to be an innovation in one area is not necessarily an innovation in another one. In a study completed in 1967,[2/] innovation was defined as a new or different process, methodology, organization, or program that is conceived or introduced into the classroom, school, or school system, on the assumption that better education will result.

This study considers innovation in the following 10 categories:

- reading programs, but not including remedial work;
- organizational innovation;
- advanced placement, enrichment, and honors courses, and any special program for the academically talented;
- remedial and special education programs, but not including Head Start programs;
- national curriculum programs;
- instructional technology, including education television;
- guidance and counseling programs;
- independent study programs other than special honors courses;

[1/] This is an expanded version of an article entitled "Relationships Between Innovation and Some School Factors in Kentucky," published in School and Society, November 23, 1968, p. 438-440.

[2/] William N. Pafford, "Relationships Between Innovation and Selected School Factors" (unpublished doctoral dissertation, University of Kentucky, Lexington, 1967), p. 1-95.

- pre-school programs, including Head Start program; and
- adult education programs.

Relationships were then determined between the number of innovations in the categories above and the following school factors:

- a quality ranking;[3/]
- mean age of the principals in the school districts;
- length of the superintendent's tenure;
- local revenue devoted to education in the school districts; and
- enrichment expenditure in the school districts.

Procedure

A sample of 12 school districts was selected from the Central Kentucky area. It was not a random sample, as the sample was selected from the 59 school districts which participated in the Kentucky Survey of Educational Change.[4/] In addition, since district size may influence administrative personnel, the sample was selected so that school districts of different sizes (average daily attendance) would be represented. After the sample was selected, a structured interview was conducted with each district superintendent and, in most cases, with one or more supervisors. Schools in the districts were then visited in order to obtain complete data with respect to the number of innovations in the categories listed above. From each school district, the following data on innovation were collected:

(1) Name of innovation (one of the ten listed earlier).

(2) Year innovation was adopted.

(3) Grade level affected by the innovation.

(4) Whether or not innovation was tested prior to its introduction.

[3/] Charles F. Martin, "Quality Education Study," (unpublished doctoral dissertation, University of Kentucky, Lexington, 1967). This study used computer techniques on 19 different variables to arrive at a quality ranking.

[4/] Richard I. Miller, Director, "Kentucky Survey of Education Change" (unpublished material, College of Education, University of Kentucky, 1965-66).

(5) Whether or not innovation was subsidized by federal funds.

(6) Difficulties encountered during introduction of the innovation.

(7) Source of innovation, whenever possible.

A quality ranking of the school districts was obtained from the Kentucky Quality Study[5]. Data regarding the other factors related to innovation were obtained from the Kentucky State Department of Education.

In a large district with many teachers and administrators, there are more opportunities—more change agents—for innovation than in a small district. In this study, therefore, an index figure representing the number of innovations per child was used. In addition, both local revenue and enrichment expenditure were calculated on a per-pupil basis.

In this study the number of innovations per child in average daily attendance during the 1965-66 school year was the dependent variable. Total innovations per child were first considered for all grades; total innovations in grades one through six only were then considered separately; next, innovations in grades seven through twelve were considered separately; lastly, innovations in all grades, but excluding innovations which are subsidized by federal funds, were considered.

Multiple regression was the primary statistical tool. The method is described as follows: "Multiple regression is used in data analysis to obtain the best fit for a set of observations of independent and dependent variables by an equation of the form: $Y = b_0 + b_1X_1 + b_2X_2 \ldots b_nX_n$, where Y is the dependent variable, $X_1, X_2, \ldots X_n$ are the independent variables, and $b_0, b_1, b_2, \ldots b_n$ are the coefficients to be determined."[6]

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[5] William J. Diamond, Charles F. Martin, Sr., and Richard I. Miller. Quality Rankings of Kentucky School Districts. Lexington, Kentucky: The Bureau of School Services, 1968. 225 pp.

[6] Selwyn A. Zerof, Statistical Library for the 7040 Programs and Subroutines (Lexington: University of Kentucky Computing Center, 1966), p. 71.

The coefficient of determination, designated as R^2, was determined for each equation. When multiplied by 100, R^2 gives the percentage of the variance in the dependent variable that is associated with, or accounted for by, variance in the independent variable or variables.[7] The F value was also determined for each equation; any F value which was significant at the .10 level was considered to be statistically significant.

Results of the Study

Relationships Involving the Total Number of Innovations in the Sample of School Districts

The total number of innovations per pupil in average daily attendance was designated as X_1. X_1 was found to be significantly related to a quality ranking (X_5) and to the local revenue per pupil that is devoted to education (X_{10}). The regression equations are given below, along with a brief explanation:

$$X_1 = 9.02413 + (-0.09215)\, X_5$$

$$R^2 = 0.2964$$

The R^2 of 0.2964 indicates that almost thirty percent of the variance in the number of innovations in the sample is associated with the variance in district quality (as determined by the quality ranking). The negative value of the regression coefficient is explained by the fact that the higher the quality ranking, the smaller the number - i.e., 01 (highest), 02, 03, . . . 25, etc. School districts in the sample which rank high in innovation will also tend to rank high in quality.

$$X_1 = 3.03146 + 0.02164\, X_{10}$$

$$R^2 = 0.3197$$

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[7] J. P. Guilford, Fundamental Statistics in Psychology and Education (New York: McGraw-Hill, 1956), p. 379.

The positive regression coefficient indicates that the most innovative school districts tend to devote more local funds to education than do the least innovative districts. Almost thirty-two percent of the variance in innovation in the sample is associated with the variance in the amount of local funds devoted to education by the school districts.

X_1 was not found to be significantly related to any of the other independent variables, or to any combination of the independent variables.

Relationships Involving the Total Number of Innovations Affecting Grades 1 - 6 Only in the Sample of School Districts

Of the various independent variables and combinations of variables, the only statistically significant relationship involved the amount of local revenue that is devoted to education by the school district. The regression equation is given below:

$$X_2 = 3.33019 + 0.02938\, X_{10}$$

$$R^2 = 0.2970$$

The R^2 of 0.2970 indicates that almost thirty percent of the variance in innovation in the sample of school districts, grades 1 through 6 only, is associated with the variance in local funds devoted to education by the school districts.

Relationships Involving the Total Number of Innovations Affecting Grades 7 - 12 Only in the Sample Districts

When the number of innovations affecting grades 7 through 12 (X_3) was considered separately, none of the independent variables or combinations of variables were significantly related to innovation. It is clear that little was gained by considering the elementary and secondary grades separately.

Relationships Involving the Total Number of Innovations in the Sample of School Districts, Excluding Innovations Which are Directly Subsidized by Federal Funds

When the total number of innovations in the school district is

considered, but excluding innovations which are directly subsidized by federal funds, it becomes clear that federal funds seem to stimulate innovation. Regression analysis reveals that both the quality ranking (X_5) and local revenue devoted to education (X_{10}) show a high correlation with the total number of innovations not federally subsidized (X_4). These two regression equations are given below:

$$X_4 = 6.98691 + (-0.09096)\, X_5$$

$$R^2 = 0.4168$$

Almost 42 percent of the variance in X_4 is associated with the variance in quality ranking in the sample.

$$X_4 = 0.96587 + 0.02209\, X_{10}$$

$$R^2 = 0.4805$$

Over 48 percent of the variance in X_4 is associated with the variance in local revenue devoted to education.

In addition to the above, several combinations of independent variables were significantly related to X_4. In every case except one, however, the R^2 was considerably less than in the two equations above. The predictive values of X_5 and X_{10} are much higher when considered alone than when they are combined with the other independent variables. The only exception to this statement arises when X_5 and X_{10} are combined; the regression equation is given below:

$$X_4 = 3.16684 + (-0.03936)\, X_5 + 0.01529\, X_{10}$$

$$R^2 = 0.5131$$

It is clear that school districts in the sample which tend to rank high in the number of non-federally subsidized innovations will also tend to rank high in both district quality and local expenditure for education. The R^2 of 0.5131 indicates that over 51 percent of the variance in innovation, excluding federally subsidized innovations, is associated with the variance in the above combination of variables. It should be noted, however, that variable X_{10} alone accounted for 48 percent of the variance in variable X_4; X_{10} is a better predictor than is any other single independent variable. When variables X_5 and X_{10}

are combined, there is only a very slight increase in the R^2 over the R^2 resulting from the regression equation involving variable X_{10} only. To state it more simply, while both X_5 and X_{10} seem to be effective predictors of innovation, excluding federally subsidized innovations, little predictive value is gained by combining the two factors. Variable X_{10} is the best single predictor.

Additional Data Obtained from the Study

It was determined that few innovations were tested prior to their introduction. According to statements by superintendents, supervisors, principals, and teachers, only about 14-1/2 percent of the total number of innovations[8/] were pre-tested.

It was reported that difficulties were encountered in the implementation of thirty-two of the innovations, or about 22 percent of the total. The only innovation listed as causing difficulty in more than two cases was the adoption of modern math, which was reported by five different school districts. In each of the five districts, a lack of training or preparation on the part of the teachers involved was mentioned as the reason for difficulty. This particular problem was mentioned in connection with other innovations as well.

An attempt was made to ascertain the source of the reported innovations. In some cases this was impossible, but classroom teachers were mentioned most frequently as a source. Next in frequency was administrative planning involving more than one person. These two sources make up approximately 71 percent of the reported sources. In the case of 22 percent of the innovations, the availability of federal funds was mentioned as being the reason why the programs were installed. One of the most surprising results of the study was the fact that supervisors were rarely mentioned as sources of innovation (4 percent of the reported sources). One might question whether or not supervisors are functioning in a creative manner in the sample of school districts.

Analysis of Data

Care must always be taken when generalizing from one study involving one sample. At the same time, the findings of this study have certain implications, especially as regards further research.

8/ The total number of innovations reported by the sample of districts, in the ten categories mentioned previously, was 146.

Innovation and Educational Quality

The results of this study indicate a significant relationship between innovation and educational quality. Measurement of educational quality is extremely difficult, however, and results may vary from study to study. Many criteria have been used in the determination of educational quality. Although the quality ranking utilized in this study has been developed on the basis of extensive information, there is a need for further validation of the significant relationship mentioned previously. This study applies specifically to Central Kentucky. At the same time, if further investigation substantiates the findings described here, it can then be theorized that a significant improvement in the quality of education will probably occur in school districts where the faculty and administration are innovative and amenable to change—or that educational quality will remain high.

Innovation and Local Revenue Devoted to Education

The results of this study indicate that a significant relationship exists between innovation and the amount of local revenue that is devoted to education. There is no doubt that money—whether from state or local sources—is a necessary prerequisite from many innovative programs. In past years, Paul Mort and his associates have made many studies of school adaptability (adaptability and innovativeness are essentially the same). Mort's work has been summarized by Rogers as follows:

> Among the great variety of factors related to innovativeness (or 'adaptability') among schools, the best single predictor of this dimension is educational cost per pupil. The wealth factor almost appears to be a necessary prerequisite for innovativeness among public schools.9/

It has been pointed out by Kumpf that among other characteristics, an adaptable (or innovative) school tends to be located in a

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9/ Everett M. Rogers, Diffusion of Innovations (New York: The Free Press of Glencoe, 1962), p. 40.

community which is high in per capita wealth.[10] It seems a safe assumption that a community which has high per capita wealth will rank high in the amount of local revenue that is devoted to education.

It seems reasonable to expect a high quality staff in school districts which exhibit high local support. Wealthy school districts normally pay higher salaries and can attract better teachers than can impoverished districts. It may be, therefore, that this relationship is due primarily to the quality of the teachers and administrators in the school districts. A study of the relationship between innovation and teacher quality might clarify this point. (Or it might bring about further confusion; what measure of teacher quality would be used?)

The pupil-teacher ratio is likely to be considerably lower in wealthy school districts—and therefore in districts which exhibit high local support for education—than in impoverished school districts. Teachers in schools with lower pupil-teacher ratios will have more time to innovate than will those with larger numbers of students. This is another possible reason for the significant relationship reported here, and one which deserves further investigation.

Innovation and Tenure of the Superintendent

The length of tenure of the superintendent was not found to be significantly related to innovation in the sample of school districts. Griffiths has stated that the longer the tenure of the chief administrator of an organization, the fewer the changes which will occur.[11] From results of a study completed a few years ago, Carlson has reported that innovators—the first group to adopt a new idea or program—tend to have shorter tenure in their present position than do

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[10] Carl H. Kumpf, "The Challenge of Studies of Adaptability to an Elementary School in a Large City" (unpublished dissertation, Teachers College, Columbia University, 1949), cited by Everett M. Rogers, "What Are Innovators Like?", Theory Into Practice, ed. Jack Culbertson (Columbus: The Bureau of Educational Research and Service, 1963), p. 255.

[11] Daniel E. Griffiths, "Administrative Theory and Change in Organization," Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), pp. 435-36.

non-innovators.[12] Since the findings of Griffiths and Carlson seem to be at odds with results of this study, further research seems needed. There are several possible reasons for these contradictory findings, some of which are analyzed below:

(1) In Kentucky, as in many other states in the Southeast, regulations concerning certification as a school administrator have been strengthened within the past few years. Many superintendents have found it necessary to return to the classroom as a student on a part-time basis. It seems likely that recent course work will serve to stimulate innovation in a superintendent, even though he may have been in office for a long time. Carlson's work was completed in Pennsylvania and West Virginia; it may be that certification standards in these areas differ somewhat from standards in Kentucky.

(2) Carlson's study dealt primarily with three innovations; the study in Kentucky involved a large number of innovations. Many of the innovations considered in the Kentucky study may have been adopted solely due to the efforts of teachers, with no involvement on the part of superintendents. To illustrate this point, Haber has found that in the adoption of language laboratories in high schools, the innovation was generally initiated by the teacher.[13] There is some question as to how important the superintendent really is as regards many innovations.

(3) Carlson was not able to conclude definitely that the tenure of the superintendent was significantly related to the adoption of educational innovations. He simply pointed out a tendency based on one study. More exhaustive studies are necessary, involving different sections of the country, before definite conclusions can be drawn concerning the relationship in question. There are many factors involved in the decision of whether or not to adopt an innovation. In some areas of the country, the superintendency is a political office, and political considerations are involved.

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[12] Richard O. Carlson, Adoption of Education Innovation (Eugene, Oregon: The Center of Advanced Study of Educational Administration, 1965), pp. 64-65.

[13] Ralph Norman Haber, "The Spread of an Innovation: High School Language Laboratories," The Journal of Experimental Education, Vol. 31, No. 4 (Summer, 1963), p. 359-69.

(4) The Kentucky study was completed approximately three years after Carlson's study. Although this seems to be a relatively short time, innovation in education became really popular during the mid-1960's. Many of the programs which are properly called innovations were written about and much discussed during this period. It seems likely that some innovations were adopted by many school districts simply because of the "bandwagon" effort and not because of any particular innovative characteristic or attitude on the part of the superintendent. In some cases the states may have appropriated additional money specifically for a particular program. In addition, the advent of large amounts of federal funds has certainly affected the adoption of some programs. The effect of federal funds on innovation is discussed more fully in a later section of this paper.

In order to draw definite conclusions regarding this matter, a larger sample should be used. This is true of both the Kentucky study and Carlson's study. A study involving all school districts in a particular state might resolve the apparent contradiction.

Innovation and Enrichment Expenditure

The writer was surprised to find no significant relationship between innovation and enrichment expenditure in the sample of school districts. As used in this study, enrichment expenditure refers to money spent for audio-visual materials, test, supplemental books, teaching supplies, and instructional travel. This finding was in sharp contrast to the results of Campbell's study concerning enrichment and adaptability.[14/] It may be that other items should be included as enrichment expenditure. On the other hand, it is possible that all school districts in the sample have reached a point of development so that enrichment funds are available in sufficient quantity. Since this possibility is highly unlikely, there is a need for further research in this area.

Innovation and the Mean Age of the Principals

The mean age of the principals in the school districts was not

[14/] James Allan Campbell, "Small Item Expenditure and School Quality - A Cost-Quality Study" (unpublished dissertation, Teachers College, Columbia University, 1956), cited by Donald H. Ross, ed., Administration for Adaptability (New York: Metropolitan School Study Council, 1958), p. 371.

significantly related to innovation. In his study of superintendents in Pennsylvania and West Virginia, Carlson found that innovators—the first group to adopt a new idea or program—tended to be younger than non-innovators.[15] Since Carlson's study dealt with the age of superintendents, whereas this study dealt with the age of principals, no real comparison can be made. The writer was somewhat surprised, however, to find no significant relationship between innovation and the mean age of the principals in the school districts. Again, since many older school administrators in Kentucky are continuing their education, both young and old principals may be knowledgeable about modern developments in education. In addition, older principals are normally more experienced than are young principals, and the experienced principal may be better able to successfully implement a particular innovation than is a younger, less experienced person.

Innovation and Federal Funds

There is a need for research on the effect of federal funds on innovation in school districts. The Elementary and Secondary Education Act of 1965 made relatively large sums of money available to impoverished school districts. By utilizing this federal money, school districts should be able to develop innovative programs which were previously unattainable due to the cost involved.

Have school districts taken advantage of this opportunity? Have they been quick to adopt innovation, to develop modern, improved programs? Although much has been written about federally-financed programs in general, specific evidence seems to be lacking as to the efficacy of federal funds in bringing about innovation in school districts. In one recent study, Burkett has reported on a survey of 156 elementary schools in Kentucky. In an attempt to determine the number of innovations adopted each year from 1960 through 1966, he found an increase of 134 percent in the number of adoptions for 1965-66 over the average for previous years. He concludes that the Elementary and Secondary Education Act has significantly influenced innovation in Kentucky Elementary Schools.[16] This is in accord with the results obtained by the writer. As mentioned previously, the availability of federal funds was given as the reason why 22 percent of the innovations were adopted in the sample of school districts. Federal funds seem to bring about an equalization among school districts as to innovation;

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[15] Carlson, loc. cit.

[16] Charles W. Burkett, "Educational Innovation in Elementary Schools," Kentucky School Journal (December, 1967), p. 44-46.

when federally supported innovations are excluded, variation among the sample is increased. It seems likely, therefore, that federal funds do bring about a decrease in the gap between the "have" and the "have not" school districts.

Closing Statement

In summary, the best predictor of innovation, among the many variables tested in this study, is the amount of local revenue that is devoted to education by the school district. If further research substantiates this relationship, and the amount of local revenue that is devoted to education proves to be a reliable predictor of innovation in school districts in general, the public should be made aware of this fact. It is likely that most people truly want good schools for their children. If the people in a community felt that an increase in the amount of local funds devoted to education would be accompanied by more innovation, by more modern educational practices, they might then be willing to sacrifice truly for their schools. It may be, too, that administrators and teachers could stimulate the people in a community through their innovative efforts; the public would probably be inclined to give adequate financial support to a superintendent who was bringing about demonstrable changes in the direction of modern, improved, educational practices.

If an innovation is to be successfully established in a school district, it should first be pre-tested on a limited basis, and teachers should receive special training to insure their ability to implement the new practice. In view of the number of times modern math was mentioned as causing difficulty, it is especially important that preparation of teachers in this field be strengthened. Even though modern math is no longer considered to be an innovation in most areas of the country, having been widely adopted, the writer is convinced that its adoption has weakened the curriculum in many school districts. This is not to say that modern math is bad; on the contrary, it represents a considerable improvement over traditional approaches to mathematics, if the teachers are qualified to present it effectively. Unfortunately, in many cases teachers have been called upon to teach modern math without proper training, sometimes with disastrous results.

It is clear that a multitude of factors are involved in the adoption of educational innovation. Some of the many factors other than those used in this study which seem worthy of investigation are attitudes and personal characteristics of teachers; availability of clerical assistance to teachers; free time available to teachers for preparation; money spent for a professional library for teachers; and the pupil-teacher ratio in the school district.